(12) UK Patent Application (19) GB (11) 2 021 049 A

(21) Application No 7910718
(22) Date of filing 27 Mar 1979
(23) Claims filed 27 Mar 1979
(30) Priority data
(31) 907086
(32) 18 May 1978
(33) United States of America (US)
(43) Application published 28 Nov 1979
(51) INT CL²
B60C 11/08
(52) Domestic classification
B7C 3D3
(56) Documents cited
GB 1388534
GB 1236335
(58) Field of search
B7C
(71) Applicants
The Firestone Tire & Rubber Company,
1200 Firestone Parkway,
Akron,
Ohio 44317,
United States of America.
(72) Inventor
Peter McDonald.
(74) Agents
Stevens, Hewlett & Perkins.

(54) **Pneumatic tire primarily for agricultural tractors.**

(57) A pneumatic tire for a drive wheel of an agricultural vehicle has a tread design comprising a series of principal traction bars 3 located on each lateral side of the circumferential centerline 2 of the tread and extending axially outward from the centerline to the shoulders of the tread with each pair of adjacent bars on each said side defining a pocket 5 in the tread design. The bars on one side are circumferentially staggered relative to the bars in the other side.

The pocket between each two traction bars on each side of the centerline contains a fin 4 which is connected to the centerline end of a bar on the other side of the centerline and extends axially outward in the pocket terminating in a shoulder area of the tire. Each fin has an average height not greater than 25% of the average height of the said alternate principal traction bar.

FIG.1

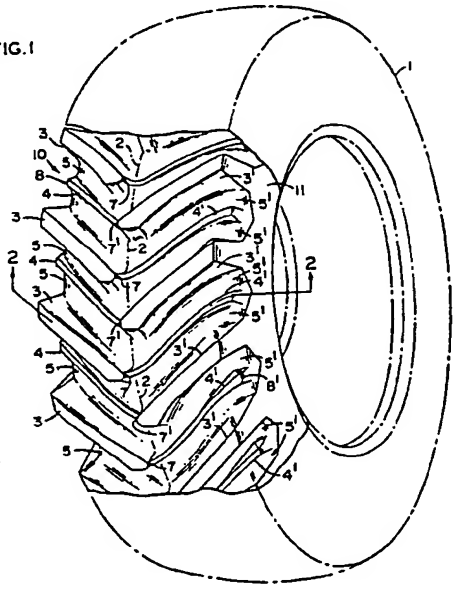

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FIG.1

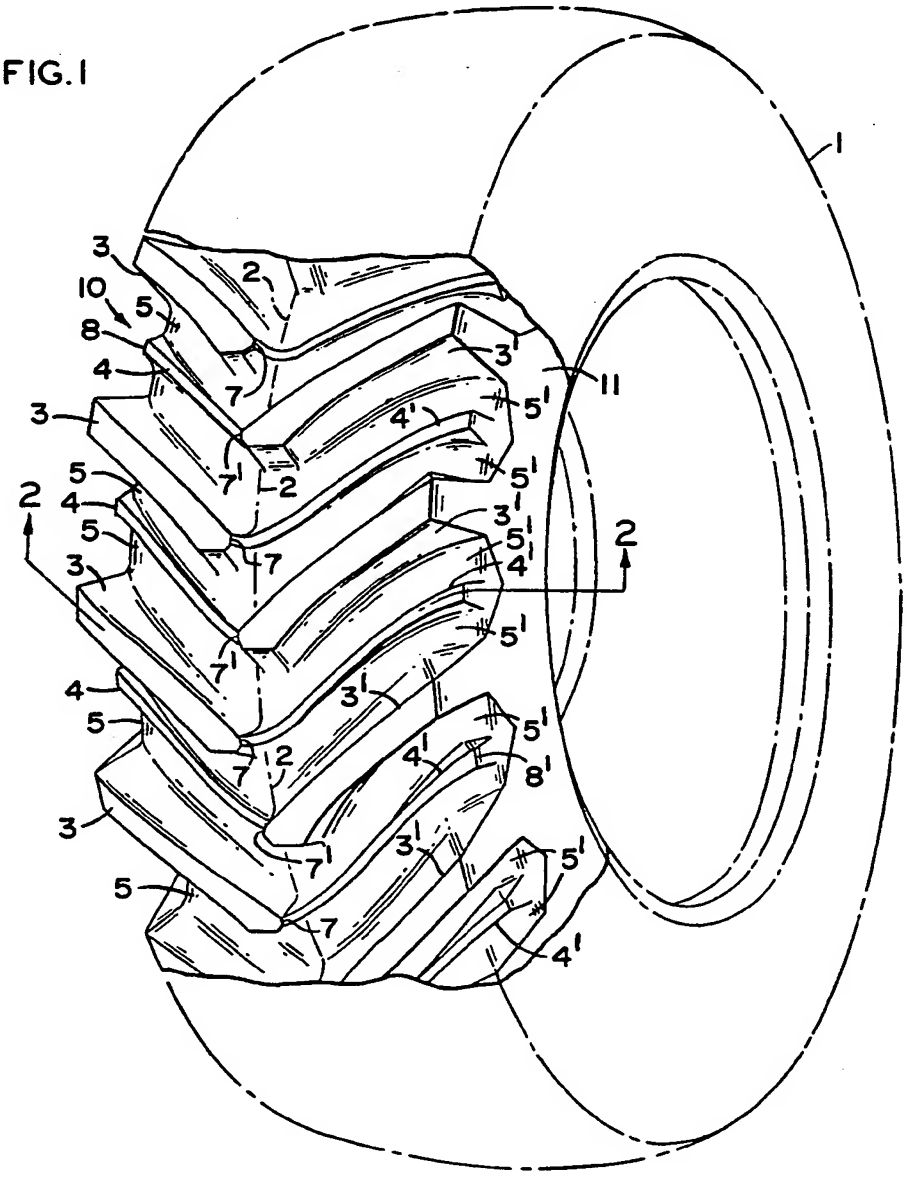


FIG.2

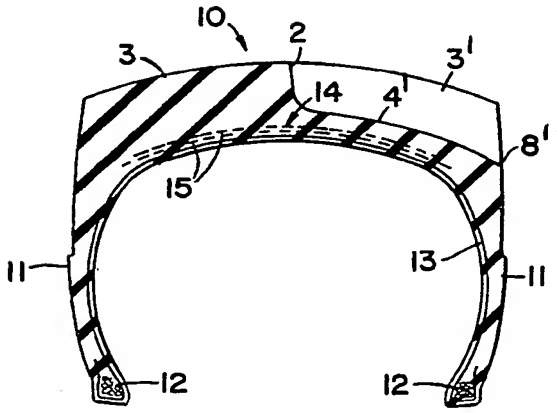
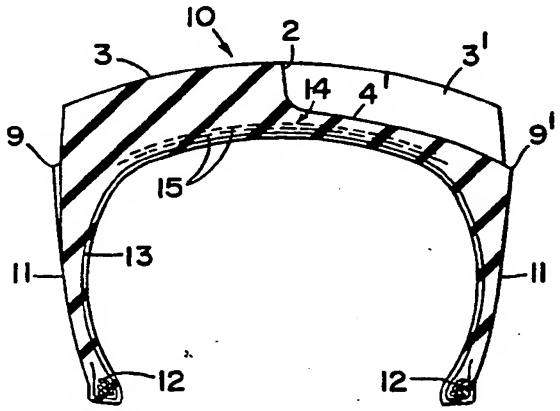


FIG.3



SPECIFICATION

Pneumatic tire primarily for agricultural tractors.

This invention relates to a pneumatic tire for agricultural use, primarily a pneumatic tire designed for the drive wheel of agricultural vehicles such as tractors. Tires of this type require specialised tread designs to meet the particular conditions under which they are used. The tread designs in these tires are not required to withstand high sustained speeds on highways or extremely heavy loads, but are required to have excellent traction in soft surfaces such as ploughed fields or mud and to give long wear under these conditions.

The traction aspect of such a tire design has two components; longitudinal traction and lateral traction. Longitudinal traction is traction in the direction the vehicle is travelling; lateral traction is traction at 90 degrees to the direction of travel of the vehicle. This lateral traction is necessary to prevent slide slipping of the tire and vehicle.

The long-wear aspect of tire design for agricultural tractors is unique in that these tires, due to the low speed service, will be on the vehicle for a period of several years. Such designs must be able to withstand constant rough service over rocky ground with the inherent danger of punctures. Additionally, as the principal bars of the tread wear off. the pockets or spaces between them become more and more vulnerable to puncture and abrasion. This is particularly true with radial construction tractor tires as explained below.

In the past, tractor tires have been primarily of a standard, bias ply construction wherein the body reinforcing cords extend at an angle to the circumferential centerline of the tire, usually 25-45°. Radial tractor tiries in which the reinforcing cords in the body plies extend radially of the tire or at an angle of approximately 90° to the circumferential centerline of the tire tread are known but have only recently been commercially exploited.

In a tractor tire, particularly a radial tractor tire, the tread area or pocket between the principal bars has a tendency to protrude radially outward when the tire is inflated and operating. This is due to the restricting effect that the major bars have on the other areas of the tire. It has been found that this protrusion of the pockets between the major bars can lead to cutting and excessive wear of these tread areas, particularly when the major bars are worn off to some degree.

This invention relates to a noval tread design for tractor tires and has its most important application in radial ply tractor tires, alleviating some of the problems that are more troublesome in radial ply tires than in prior bias tires.

According to this invention there is provided a pneumatic tire having an annular ground contacting tread surface having a tread design comprised of principal bars extending from the circumferential centerline of said tread surface axially outward to and terminating in the shoulder area of said tread surface, a pocket being formed between each two adjoining bars at the same side of the centerline, the bars on each side of the centerline being circumferentially staggered relative to the bars on the other side of said centerline, and one or more of said pockets having projecting from the base of the pocket a fin connected to an extending axially outward from the centerline end of the adjacent bar on the other side of said centerline, said fin extending to said shoulder area of said tread surface and having an average height less than 25% of the average height of said adjacent bar.

In preferred arrangements the said fin provides additional traction in both the longitudinal and lateral directions and provides additional wear in the tread surface area between the major bars. The average height of the fin in relation to the average height of the principal bars is important and must be less than 25%.

The angle of the principal bars to the circumferential tread centerline may be any of the standard, known angles, such as 23 or 45 degrees and is preferably within the range 20 to 50 degrees.

In preferred constructions each principal bar has its centerline end circumferentially between the centerline of the adjacent bars on the other side of the centerline and the pockets between adjacent principal bars, each contain a continuous fin that extends axially outward from the centerline end of a bar on the other side of the centerline and terminates in the shoulder area of the design. The fin is connected to the said centerline end of the said bar. It may be parallel to the adjacent principal bars or at some other angle to the direction of travel. The shoulder end of the fin may terminate axially inward, axially outward or axially level with the shoulder ends of the adjacent principal bars.

The average height of the fin must be less than 25% of the average height of the adjacent principal bars. The height of the fin and the major bar is measured by a perpendicular from the base of the pocket to the height of the fin or bar. This follows the standard method of measuring "skid depth" well recognised in the industry. The average height is obtained by taking the height measurement at the shoulder and at the tread centerline, or as close to the tread centerline as possible as in the case of the fins, adding the two results and dividing by two to obtain the average.

The presence of these fins yields a functional, agricultural tread design wherein the tire has improved resistance to slippage in both the lateral direction and the longitudinal direction and hence has improved traction. The fin also provides a greater tread surface in the pocket area of the tire and thus increases the tread wear resistance of the tire in this area.

Two embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a perspective view of the tire according to this invention,

Figure 2 is a sectional view on the line 2-2 of Figure 1, and

Figure 3 is a sectional view of another embodiment of this invention.

Referring to Figures 1 and 2 the tire 1 has ground

contacting tread surface 10 connected at each of its lateral edges to beads 12 by sidewalls 11. Reinforcing elements in the tire are shown as body plies 13 which extend from one bead to another being wrapped around the beads in a standard manner. A stabilizer belt 14 comprising stabilizer plies 15 is located in the crown area of the tire in a standard manner between the road engaging tread surface 10 and the body plies 13.

The materials, location, and methods of manufacture relating to the structural features of the tire of this invention are standard and do not represent part of the novelty of this invention. For example, the beads may be comprised of any known materials used for tire beads, such as wire strands or glass strands; the body reinforcing plies may be comprised of any of the known materials, such as steel cables, glass cords, textile materials (nylon, rayon, polyester) and may be present in any desired number of plies depending upon the size and strength required for the tire; the stabilizer belt may be comprised of any of he standard materials used in this area such as steel cords, aramid cords, glass cords or textile cords (nylon, rayon or polyester) and may be present in any desired number or width depending upon the size and strength needed in the tire, it is also understood that the ends of the cords in the stabilizer belt may be folded over the ends of other cords in the belt; and the sidewalls and tread may contain any of the known materials utilized in these areas and comprise rubber compounds of natural and synethic rubbers reinforced with carbon blacks and other fillers and protected against aging by waxes and antioxidants and antiozidants.

Referring to Figures 1 and 2 the tread design 10 has a circumferential centerline 2 which divides the tread into a left-hand side and a right-hand side. The left-hand sixde contains principal traction bars 3 and fins 4 located in pockets 5 which are formed between adjacent traction bars 3. The right-hand side of the tread contains principal tractions bars 3' and fins 4' located in pockets 5' which are defined by the adjacent traction bars 3'. The circumferential location of the traction bars alternate from one side of the tread design to the other, i.e. the bars on each side of the centerline 2 are circumferentially staggered with respect to those on the other side. As shown in Figure 1, therefore, the centerline end of a companion, alternate traction bar at one side is located circumferentially between the corresponding centerline ends of its two adjacent traction bars on the other side of the tread. This end 7 or 7' provides the beginning point for a corresponding fin.

Each traction bar is provided with a corresponding fin located in the pocket in the other side of the tread design. This corresponding fin 4' extends from and is connected to the end 7 of the traction bar. It is continuous and terminates at 8' in the shoulder area of the tread design and is thus located in the pocket formed by the two adjacent traction bars 3'. In Figures 1 and 2, the fin is shown substantially parallel to the corresponding traction bars.

This total relationship of the fin to the alternate bar and the adjacent bars is specifically demonstrated in Figure 1 by the relationship of fin 4 in pockets 5 on the left-hand side of the tread design to its corresponding adjacent traction bars 3 on the left-hand side and to its alternate bar 3' on the right-hand side. Fin 4 is connected to the centerline end 7' of alternate bar 3' extends in pocket 5 axially outward, parallel to bar 3 and terminates in the shoulder at 8. This termination is axially inward of the end of bars 3. This relationship may be repeated throughout the entire circumference of the tire, from side to side, or may be in only a certain part of the circumference.

The average height of the fin is not greater than 25% of the average height of the corresponding traction bar. The height of the traction bar and the fin is measured by the perpendicular from the base of the pocket in the tread design to the top of the fin or bar. The average height of each is obtained by measuring the height at the tread shoulder and the tread centerline, and averaging the two measurements. Both the fin and the traction bars have a uniform slope between these measuring points.

The angle of the traction bar and its corresponding fin to the circumferential centerline of the tread may be between 20 and 50°, and is preferably 45° or 23°.

All of the drawings show one fin in the pocket between two adjacent bars. One or more additional fins may however be placed in the pocket if desired.

Figure 3 illustrates another embodiment of this invention. The reference numbers in Figure 3 are the same as those in Figures 1 and 2 and refer to the same structural parts of the tire. In Figure 3 the shoulder end 9' of the fin 4' is shown as being axially outward of the shoulder end of its adjacent traction bars 3' and the shoulder end 9 of the fin 4 is shown as being axially outward of the shoulder end of its adjacent bars 3. This embodiment yields additional longitudinal traction as this extension of the fin acts as a paddle. The design of this invention permits the incorporation of this feature and yields a stable structure wherein the extension (paddle feature) is protected (by the adjacent bars) from damage in service.

This invention has been employed in a 16.9 R34 radial rear tractor tire". This tire has a section width of 16.9 inches, a rim diameter of 34 inches and a section height of 14 inches. In this tire, the height of the traction bar 3 or what is known in the art as its "skid depth", at the tread centerline is 1.94 inches as measured from the base of pocket 5 in the design. The height or skid depth of the bar in the shoulder area was a maximum of 2.70 inches, again as measured from the base of the pocket by a perpendicular at this location. The skid depth of the corresponding fin 4' was .1 inches at its lowest point near the tread centerline.

The height of the fin increased to a maximum of .7 inches at the shoulder area of the tread in a gradual sloping configuration which corresponded to the sloping of the pocket of the tread design. The average height of the fin was 17% of the average height of the traction bar.

The width of the traction bars varied from 1.3 inches to 1.7 inches with the major portion of the bar being 1.3 inches and the wider portion being located near the tread centerline. The width of the fin was approximately .85 inches along its entire lateral

distance. The approximate distance from one adjacent bar to the other was 4.55 inches; this corresponded to the width of the pocket defined by adjacent bars.

The fin was located equidistant between two adjacent traction bars and was connected to its companion alternate traction bar at the centerline. The circumferential distance between the shoulder end of the fin and the shoulder end of its adjacent bars was between 2.7 inches and 3.1 inches. The shoulder end of the fin was offset .05 inches axially inward from the shoulder end of its adjacent bars.

CLAIMS

1. A pneumatic tire having an annular ground contacting tread surface having a tread design comprised of principal bars extending from the circumferential centerline of said tread surface axially outward to and terminating in the shoulder area of said tread surface, a pocket being formed between each two adjoining bars at the same side of the centerline, the bars on each side of the centerline being circumferentially staggered relative to the bars on the other side of said centerline, and one or more of said pockets having projecting from the base of the pocket a fin connected to and extending axially outward from the centerline end of the adjacent bar on the other side of said centerline, said fin extending to said shoulder area of said tread surface and having an average height less than 25% of the average height of said adjacent bar.

2. A tire as claimed in claim 1, wherein said bars extend to an angle in the range 20 to 50 degrees with respect to said circumferential centerline.

3. A tire as claimed in claim 2 wherein said bars extend at an angle of substantially 45 degrees with respect to said circumferential centerline.

4. A tire as claimed in any one of claims 1 to 3, wherein the fin or fins extend axially outward in a direction substantially parallel to the bars between which it is circumferentially disposed.

5. A tire as claimed in any one of claims 1 to 4, wherein at least one of said pockets has one or more additional fins.

6. A tire as claimed in any one of claims 1 to 5, wherein one or more of the first said fins extend axially outward beyond the edge of said bars in said shoulder area so that the outer ends of such fin or fins act as a paddle during tire operation.

7. A tire as claimed in any one of claims 1 to 6 and having a tire body with radial body-reinforcing cords, each cord extending at an angle of substantially 90 degrees with respect to said circumferential centerline of said tread surface.

8. A pneumatic tire substantially as hereinbefore described with reference to Figures 1 and 2, or Figures 1 and 2 as modified by Figure 3 of the accompanying drawings.

Printed for Her Majesty's Stationery Office by Croydon Printing Company Limited, Croydon Surrey, 1979.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.